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# COLLABORATIVE ENGAGEMENT APPROACHES FOR DELIVERING SUSTAINABLE INFRASTRUCTURE PROJECTS IN THE AEC SECTOR: A REVIEW

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## ABSTRACT

*The public sector has traditionally financed and operated infrastructure projects using resources from taxes and various levies (e.g. fuel taxes, road user charges). However, the rapid increase in human population growth coupled with extended globalisation complexities and associated social/political/economic challenges have placed new demands on the purveyors and operators of infrastructure projects. The importance of delivering quality infrastructure has been underlined by the United Nations declaration of the Millennium Development Goals; as has the provision of 'adequate' basic structures and facilities necessary for the well-being of urban populations in developing countries. Thus, in an effort to finance developing countries' infrastructure needs, most countries have adopted some form of public-private collaboration strategy. This paper critically reviews these collaborative engagement approaches, identifies and highlights 10 critical themes that need to be appropriately captured and aligned to existing business models in order to successfully deliver sustainable infrastructure projects. Research findings show that infrastructure services can be delivered in many ways, and through various routes. For example, a purely public approach can cause problems such as slow and ineffective decision-making, inefficient organisational and institutional augmentation, and lack of competition and inefficiency (collectively known as government failure). On the other hand, adopting a purely private approach can cause problems such as inequalities in the distribution of infrastructure services (known as market failure). Thus, to overcome both government and market failures, a collaborative approach is advocated which incorporates the strengths of both of these polarised positions.*

**KEYWORDS:** Collaborative Engagement, Private, Public, Sustainable Infrastructure.

## INTRODUCTION

The Architecture, Engineering and Construction (AEC) sector is extremely diverse in both scale and nature, ranging from traditional house buildings, through to complex structures. This plays an important role in the economy of most nations. The scope of activities in this sector also includes mechanical and electrical engineering works, roads, dams, airports, bridges, tunnels, petro-chemical, harbour, mining etc. (Adetola and Ogunsanmi, 2006).

Though AEC projects share common characteristics in terms of project phases (initial concept, detailed design, construct, commission and own/maintain) and project structures

(involving a range of organisations – architects, engineers, contractors, tradesmen and manufacturers) and procurement route often depends on project size, scope, value, complexity and sophistication. Today, there is enormous emphasis on collaborative engagement approach for delivering sustainable infrastructure projects.

Infrastructure as a concept has largely been absent from economic discourses for about two centuries (Prud'homme, 2004). Notwithstanding this, by the 1990s after many years of neglect, it featured prominently on the development agenda, with renewed emphasis on the role of infrastructure in economic growth and poverty reduction (Estache, 2006). The world development report elaborated by the World Bank (1994) defined infrastructure as long-life engineering structures, equipment and facilities, and also the services that are derived from and utilised in production and in final household consumption. Other authors like Ahmed and Donovan (1992), refute this definition, indicating that the concept has evolved earlier, towards a more comprehensive definition that includes a wider range of public services that facilitate production and trade. Since infrastructure services tend to raise the productivity of other factors, it is often termed the “unpaid factor of production”.

Furthermore, the definition of infrastructure has been shifting from one focusing on physical fixed assets such as roads, airports, sea ports, telecommunications systems, energy, water distribution systems and sanitation (public utilities). It now often embodies notions of ‘softer’ types of facilities such as information systems and knowledge bases (Button, 2002). The World Bank landmark study on infrastructure (World Bank, 2004) highlighted the critical role of infrastructure in the development process. The importance of delivering quality infrastructure has also been underlined by the United Nations declaration of the Millennium Development Goals.

For many years, the public sector has traditionally financed and operated infrastructure projects using resources from taxes and various levies (e.g. fuel taxes, road user charges). However, the recent disparity between the capacity to generate resources and the demand for new facilities seem to have forced governments worldwide to look for new funding methods and sources. Inadequate infrastructure has been reported to be holding back the productivity of Sub-Saharan Africa entrepreneurs, and imposing major costs on business in terms of lost output and additional costs incurred to compensate for inadequate public services. It is widely acknowledged that infrastructure deficit is one of the key factors that prevent the Sub-Saharan Africa region from realising its full potential for economic growth, international trade and poverty reduction (World Bank, 2010; 2008; Organisation for Economic Cooperation and Development, 2006). Therefore, many countries are now contemplating Public-Private collaboration as an arrangement between public and private sectors to finance, design, build, operate and maintain public infrastructure, community facilities and related services (Tang et al, 2010; Akintoye and Beck, 2009).

Public-private sector collaboration is an evolving concept which takes many forms around the world. It is essentially an arrangement by which private entrepreneurs participate in, or provide support for the provision of public infrastructure. The private sector can be described as that part of an economy which is owned and run by individual persons, groups or business organisations usually as a means of enterprise for profit. The public sector on the other hand is the portion of the economy which is owned, controlled and run by the various levels of government (federal, state, region, local etc.) or its agencies. Collaboration is a partnering process through which individuals, groups and organisations have the opportunity to become

actively involved in a project or programme of activity. Thus, public-private sectors collaboration can be described as a method of procuring public services and infrastructure by combining the best of the skills and assets of both the public and private sectors. According to Li and Akintoye (2003), the idea of allowing private firms to finance projects or public sector infrastructure resulted in the emergence of Public Private Partnership (PPP). Hence, the words collaboration, partnership and participation will be used interchangeably in this paper.

## RESEARCH METHODOLOGY

Since 1992, PPP appears to have become increasingly popular worldwide as a vehicle for delivering large public infrastructure projects. However, this approach seems to have generated problems and issues associated with the implementation and operationalisation of these. Therefore, this study aims to identify causal problems and key issues that impinge upon the effective delivery of collaborative infrastructure projects in order to determine the core drivers that need to be aligned to existing business models for the successful implementation or delivery of sustainable infrastructure projects. This paper adopts an interpretivist/social constructivist positioning approach, as it seeks to uncover new meaning and constructs relating to public infrastructure projects delivery. The research methodological approach synthesised extant literature over the past 20 years. The temporal timeframe reflects relevance and propinquity, and the research lens adopted was ‘open-bounded’, thereby not constrained by context/regional/geographic issues. The social constructivist approach was adopted in order to ascertain drivers and relationships for further investigation, particularly covering the theories governing ‘trust’, ‘relationships’ and ‘risk’. The rationale of this approach is to uncover new meaning and insight into the pivotal areas and drivers that have the potential to shape collaborative engagement approaches for delivering sustainable infrastructure projects in the AEC sector.

## CONCEPT OF PUBLIC-PRIVATE SECTOR COLLABORATION

The concept of public-private sectors collaboration may be difficult to define due to the persistent controversy concerning what ‘partnership’ really means and the vast space which public private partnership fills between traditional procurement and full privatisation of production. Many authors have defined PPP differently and Boeuf (2003) concludes that the only consensus is that there is no one-size-fits-all definition of PPP. Partnership has been a fashionable trend since the United Kingdom (UK) Government embarked on a large-scale privatisation programme beginning with the sale of British Telecom in 1984.

Savas (2000) described PPP as an elastic or easily controlled form of privatisation. In other words, any act aimed at reducing the role of government or increasing the role of the private sector in satisfying people’s needs connotes privatisation. Savas explained that privatisation can involve delegation (i.e. government may retain responsibility and oversight functions but uses the private sector for service delivery), divestment (i.e. government relinquishes responsibility) and displacement (i.e. private sector grows and displaces government activity). In a private sector participation arrangement, the public agencies may play the role of the ‘regulator’ (Leung and Hui, 2005), ‘enabler’ by providing the enabling environment for the private partner to operate, ‘moderator’ by balancing market incentives with community interests (Sengupta, 2005) and ‘facilitator’ by assisting in project completion and reducing the developer’s risks (Lynch et al, 1999).

Furthermore, in Hong Kong, the Efficiency Unit (2008) saw public private participation as arrangements where the public and private sectors both bring their complementary skills to a project, with varying levels of involvement and responsibility, for the purpose of providing public services or projects.

## **PUBLIC-PRIVATE SECTOR COLLABORATION IN INFRASTRUCTURE PROVISION**

The rapid increase in human population in recent times coupled with globalization, technological advancements, changes in social and political environments and the challenges of economic growth and poverty might have led to unprecedented demand on government institutions to provide better and efficient services (Akintoye and Beck, 2009). Globalization has been seen as a new world order that provides a new business environment characterised by worldwide interdependence of resources, supplies, product markets and business competition (Mytelka, 2000) which often has to do with abundance of knowledge, unprecedented cross boarder transferability of information and the removal of trade barriers.

Technological change is a term often used to describe the overall process of invention, innovation and diffusion of technology (Freeman, 2007). Technological change happens to be one of the driving factors for increased private investment. The telecommunication sector, where mobile telephones have changed the way services are provided, is a typical example. But other sectors have been affected by technological change as well. For instance, sustainable forms of small and medium scale electricity generation are now possible with the proliferation of solar technology and more efficient wind generators (Estache et al., 2005).

Kumaraswamy (1998) argued that the paradigm shift that mobilised the private sector more recently resulted from a combination of forces, such as the gross inadequacies of public funding capacities, particularly in comparison with the growing aspirations of ever-increasing populations, the inefficiencies of government monopolies, the conspicuous availability of surplus private resources (financial, technical and managerial), and the formulation of creative non-recourse financing mechanisms, whereby projects could be self-funding (i.e. without recourse to other assets of the stakeholders).

## **PUBLIC-PRIVATE SECTOR COLLABORATION TRENDS**

Traditional forms of investment in infrastructure projects in developing countries are often leveraged through budgetary allocations, bilateral and/or multilateral donor funds. Thus, Olawore (2004) claimed that stakeholder's expectations and needs throughout the world are rising at a rate with which government revenue alone can no longer cope, hence government revenue needs to be augmented in order to deliver public infrastructure. In this respect, many countries are now attempting to finance new infrastructure projects through private sector participation. For example, the Government of Sri Lanka decided in 1995 that future investments in new infrastructure projects would be with private sector participation taking the form of build, operate and transfer (BOT), or build, own and operate (BOO) arrangements. This decision was taken due to insufficient resources (on the part of the Sri Lankan Government) to undertake large investments required for infrastructure projects (Liddle, 1997).



Similarly, private participation in infrastructure development in China started with the power industry in the 1980s. The Shajiao B power plant in Shenzhen, which came to operation in 1988, was the first BOT project in China. Thereafter, several state-approved pilot BOT projects such as Laibin B power project in Guangxi 1997 and Dachang water project were awarded in order to introduce BOT on a larger scale. Since then, the involvement of private investors in infrastructure development of public utilities such as transportation, water supply, gas supply, and waste disposal has improved greatly (Shen and Wu, 2005). Kumar (2010) reported that the Government of Maharashtra (India) had formulated policy to finance road development, metro rail, tourism, ports, civil aviation, power, urban development and agriculture projects through private sector participation. It was also reported that the Mumbai Metropolitan Region Department Authority planned a 146 kilometres long rail based mass rapid transit system for Mumbai.

The privatisation of prisons in Australia is also worth mentioning. For example, the Junee Correctional Centre, a prison in New South Wales, Australia, with a capacity of 750 inmates was procured through the BOO method in 1993. It was designed, financed and operated by GEO Group Australia (Department of Corrective services, 2006). The \$920 million New Southern Railway project, a 10 kilometre underground two-track railway designed to provide rail services between Sydney (Kingsford Smith) airport and Sydney Central Station, Australia was also procured (between June 1995 and May 2000) through a build, own, operate and transfer (BOOT) 30 year concession agreement between the State Government and the National Australia Bank (Loosemore, 2007).

Furthermore, the Eastern Harbour Crossing Tunnel in Hong Kong was procured through a BOT concession of 30 years. The construction of the project started in September 1986, and was completed half a year earlier than anticipated, and within budget. The success of the project was attributed to an established and equitable legal and regulatory system. Other successful BOT projects in Asia include the Hong Kong Cross-Harbour Tunnel, and the Western Harbour-Crossing Tunnel (Tam, 1999).

In a study on public private infrastructure projects in Africa, the World Bank (2010) reported that telecommunication seems to be the leading sector in Sub-Saharan Africa, both in terms of capital investment and the number of projects, energy ranked a distant second, transport came third, while investment in water and sewerage projects lagged far behind other sectors. A strategy which seems to be gaining increasing popularity in public infrastructure development in Cameroon is citizen participation involving the community, local and international non-governmental organisations (Njoh, 2002; 2003; 2006). This people-centred method is also referred to as self-reliant development or local economic development (Binns and Nel, 1999). In this respect, Chambers (1995, 1997) argued that poverty reduction efforts in developing countries are likely to be more successful when members of the target populations are afforded the opportunity to analyse and articulate their own needs as well as participate in efforts to address these needs.

The first major private sector participation infrastructure in Nigeria is the Murtala Muhammed International Airport Terminal project (Babalakin, 2008). The domestic wing of the Murtala Muhammed International Airport Terminal, Nigeria got burnt by fire in the year 2000. Government initially toyed with the idea of rebuilding it, but this did not work out (Tell, 2007). In 2003, the then Minister of Aviation, fascinated with the idea of the private sector getting involved in developing public infrastructure, got presidential approval for rebuilding

the burnt terminal on a build, rehabilitate, operate and transfer 30 year concession contract to Bi-Courtney Consortium Limited at a cost of US\$250 million. The Lagos Bus Rapid Transit transport system is another facility introduced recently in Lagos, Nigeria. This roadway-based bus transport system operates on physically segregated lands in order to guarantee fast and reliable bus travel devoid of any traffic congestion. Report has it that between 1985 and 2004, there were a total of 2096 public private partnership projects worldwide with a total capital value of nearly US\$887 billion (AECOM Consult Inc., 2005).

## **COLLABORATIVE ENGAGEMENT APPROACHES FOR DELIVERING SUSTAINABLE INFRASTRUCTURE PROJECTS**

Public Private Partnerships are widely acknowledged as an increasingly important vehicle to deliver public infrastructure development and public service (Kumaraswamy and Morris, 2002; Zhang, 2005; Akintoye and Beck, 2009; Tang et al. 2010). The United Kingdom has been recognised as the most active market in the World for this partnership, which is widely known as Private Finance Initiatives (PFI), and has also developed the most sophisticated institutional, legal, regulatory, and business structures to support the expansion of this procurement strategy. Other developed countries which have embraced public private collaboration include the United States, Singapore, Hong Kong, Australia and Germany. With particular reference to transportation, many countries including Spain, South Korea, Canada, Ireland, France, China and Brazil seem to be moving up what the 2006 Deloitte research report described as the market maturity curve (Deloitte, 2006).

Since the introduction of public private collaboration in the United Kingdom in 1997, it has been recognised as an effective way of delivering value for money in public infrastructure services (Ke et al. 2009). In this respect, Banks (2005) claimed that the system accounts for about 15% and 8% of money spent on infrastructure in the UK and Australia (developed countries) respectively. Furthermore, public private collaboration also plays a significant role in the infrastructure development of developing countries (World Bank, 2008). Generally the level of private sector participation ranges from simple service provisions without recourse to public facilities, to full private ownership and operation of public facilities and their associate services. In effect, increased private involvement in infrastructure management has often resulted in service contract, leasing, joint ventures, concession and privatisation (Li et al. 2005).

On the other hand, an extensive adoption of public private partnership by governments around the globe has often generated problems and issues associated with implementation of projects. Such problems include high cost in tendering, complex negotiation, cost restraints on innovation, and conflicting objectives among project stakeholders (Akintoye et al, 2001). In this respect, Birgonul and Ozdogan (1998) stated that many urgent energy and transportation projects planned on a BOT basis in Turkey failed due to many reasons. These reasons include poor organisation of government agencies in packaging the projects, ineffective tendering and evaluation methods used by client organisations, insufficient legal arrangements, lack of coordination between private and public sectors, and unwillingness of the Turkish Government to provide guarantees against the risks originating from Turkey's unstable economical and political environments. This was reinforced by Canakci (2006) who reported that insufficient legal framework, administrative bottlenecks, and lack of methodical approach about risk allocation between the public and private sectors are the major factors which hindered the success of BOT projects in Turkey.

Furthermore, Zhang (2005A) identified six categories of barriers for PPP/PFI projects. These include social, political and legal risks; problems related to the public sector (e.g. inexperienced government and lack of understanding of public private partnerships); problems related to the private sector (e.g. preference for traditional procurement method); unfavourable economic and social conditions; lack of mature financial engineering techniques; and inefficient public procurement frameworks. In addition, Klijn and Teisman (2003) discovered that the inability to develop good partnerships lies in a combination of three factors: complexity of actor composition, institutional factors, and the strategic choices of public and private sectors. From the foregoing, the major problems and issues that appear to have been widely associated with the collaborative engagement approach for delivering sustainable infrastructure projects can be broadly classified as, risk allocation, globalisation/collaboration, legal and regulatory framework, finance, technology, relationships, trust, market maturity, skills/competence and communication.

### **Risk Allocation**

The need for project participants to identify and understand all potential risks associated with a project in order to ensure that risks are properly allocated to the party with the best financial and technical capabilities to manage them has been widely acknowledged (Ward et al, 1991; Edwards, 1995; Flanagan and Norman, 1993). In this regard, Woodward (1997) and Charoenpornpattana and Minato (1997) studied risk allocation and sharing in respect of project financing and privatisation. They identified various risks such as social and political risks, environmental risks, technical risks, as well as economic risks which may emerge at different stages of a project life cycle. Social and political risks include instability of government, corruption/bribery, uncertainty of government policy, unfair process of selection of private investors, political influence, changes in laws and regulations, nationalisation, internal and labour resistance, inefficient legal process and legal barriers. On the other hand, economic risks include: foreign exchange risk, devaluation risk, price escalation, inflation risk, inconvertibility of local currency, interest risk, general liability risk, management risk, too small number of interested investors, incapable investors, and small capital market demand and supply risks.

Similarly, Merna and Smith (1996) classified the risks of partnership projects into two broad categories: global and elemental. Risk factors in the first group are generally those outside the control of the project participants, including political, legal, commercial, and environmental factors. The latter group contains mostly the project-level risks, such as construction, design, operation, finance, and revenue risks. In addition, Li et al. (2005) proposed an approach to classify partnership project risks into three levels: macro, meso, and micro. The macro-level risks are those risks external to the project itself; the meso-level risks are project-related risks; while the micro risks are partly-related risks.

### **Globalisation/Collaboration**

Globalisation has to do with the creation of a 'Global Village', a process that brings the world closer through better international communication, transport and trade links. Globalisation has been defined as the multiplicity of linkages and interconnections that transcend the nation-states which make up the modern world system. It often describes a process through which events, decisions and activities in one part of the world can come to have significant consequences for individuals and communities in quite distant parts of the globe. In this



regard nowadays, goods, capital, people, knowledge, images, communications, crime, culture, pollutants, drugs, fashions and beliefs all readily flow across territorial boundaries. Thus, transnational networks, social movements and relationships appear to be widespread in nearly all areas of human endeavour/activities (McGrew, 1992).

The European Union's (EU) internal market appears to have undergone a massive change in the past few years. Member states seem to be benefiting greatly from the world's largest free market, and in particular, the liberalised transport market for both goods and passenger carriage in 1998 is apparently helping to promote the socio-economic cohesion of the Union (European Commission's Directorate-General for Energy and Transport, 2006). Open markets may be a good engine that fits living standards and build shared prosperity. In this regard, countries that open up their economies to trade, capital movement and competition are likely to see significant increases in per capita income, social and economic progress. The benefits of globalisation may also include increased liquidity of capital allowing investors in developed nations to invest in developing countries, greater ease and speed of transportation for goods and people, and the reduction of cultural barriers thereby expanding the global-village effect.

Ever before now, the public and private sectors had collaborated to deliver public infrastructure using a variety of methods, which divided responsibility differently. Collaboration is often quite different from a situation where the government only seeks for the advice or solicits for the input of the organised private sector on policy issues/decisions. It implies that there is some shared responsibility between the public sector and private sector for tangible deliverables (Collin, 1998). In this regard, Grantt (1996) asserted that shared authority and responsibility, joint investment, shared risk/liability, shared resources and rewards, and mutual benefit are the thrust of collaboration. Early collaborative engagement approaches for delivering infrastructure mostly employed the Design-Bid-Build (Traditional) model that assigns the public sector primary responsibility (Yakowenko, 2004). However the traditional forms of project procurement seem to have been characterised by abandoned projects, inflated contracts, trade dispute among players, unnecessary time and cost overrun, clients' inability to obtain 'value for money', delay in project completion and occupation, use of inferior building materials which often lead to several defects in construction, and eventual building collapse (National Economic Development Office, 1986).

In the 1980s, governments around the world began to experiment with the privatisation of infrastructure delivery, using the Build-Own-Operate (BOO) model as a way to generate funds for new infrastructure projects and improve the efficiency of service provision. This attempt received strong political opposition (Gomez-Ibanez, 1996; Sclar, 2001). Thus, in the early 1990s, the UK led the way with projects that bundled facility design, construction, financing and operation into a single long-term concession. This approach seems to have become popular worldwide as a method of delivering large and complex public sector transportation projects. Furthermore, it probably has helped to align the interests, rewards and risks of both public and private partners through a long-term contractual relationship (Grimsey and Lewis, 2005). Public-Private collaboration appears to have developed into extensively applied delivery vehicles for large and complex infrastructure projects, crossing international borders and diverse governmental structures to form an essential support for global economic growth (Liu and Cheah, 2009). The likely obstacles to effective implementation of collaborative engagement approaches in developing countries may include

an absence of efficient, transparent and participatory policies, mechanisms and institutions in such countries (Akintoye and Beck, 2009).

### Legal and Regulatory Framework

The need for a comprehensive legal and regulatory framework which is clear, transparent and predictable for efficient, effective and fair bidding procedures has been emphasised (Asian Development Bank, 1996, 1997; Harris, 2003). The legal environment where projects operate often influences to a large extent the willingness of the private sector to collaborate in infrastructure project development. Therefore, in order to attract private sector participation, the government has to develop adequate legal and regulatory framework, as well as a financial environment, congenial to investment and attractive to foreign investors (Kumaraswamy and Zhang, 2001). It has been argued that the success of public private collaboration revolves around availing an adequate and enabling legal and regulatory framework that critically analyses services, partners and a 'value for money' procurement strategy (Zhang, 2005B; Bing et al, 2005). This is necessary, since disputes are likely to occur and service delivery delayed and/or impaired (Institute of Public Private Partnerships, 2000). The existence of a functioning legal and regulatory framework reduces opportunistic tendencies (Kuttner, 1997), aligns the interest of partners and also provides confidence to the private partners, as it acts as a buffer against political interference from government agencies (Pongsiri, 2002). Whether an investment is recouped through tolls, sales or other tariffs, it is always the end users/consumers who ultimately pay the cost of the project (Pahlman, 1996).

### Finance

Infrastructure projects are often large, complex and capital-intensive in nature, hence may require innovative financial strategies. Project financing seems to be one such innovative financial engineering technique in which a project is considered as a distinct legal entity, and the financing of the project is repaid from the cash flows generated by that same project (Merna and Dubey, 1998). For example, the Hong Kong government adopted three sets of criteria to evaluate tenders for its BOT tunnel projects, and assigned weights to these criteria in their order of importance. The sets of criteria and their assigned weights are finance, 65%; engineering, 20%; and planning of operation and transport, 15%. The higher weight assigned to the financial criteria in this evaluation reflects the importance of a sound financial plan to the success of an infrastructure project (Zhang and Kumaraswamy, 2001). Similarly, Zhang (2005B) found that a concessionaire's financial capacity can be measured by four dimensions: strong financial engineering techniques, advantageous finance sources and low service costs, sound capital structure and requirement of low-level return to investments, and strong risk management capability. Partnership projects are often funded with both equity (e.g. common stock) and debt (e.g. loans). A common practice is to utilise as much debt as the project cash flows permit to generate an attractive return for shareholders. In this regard, the capital structures in most partnership projects are highly leveraged, with equity financing covering 10-30% of total project costs and debt financing covering the remaining 70-90% (Levy, 1996). Although a higher debt may allow for higher rate of return to equity investors, too much can provide more risks to a project. Therefore, an appropriate mix of equity and debt is necessary when financing a public private collaborative project (Zhang, 2005C).

## Technology

Technology has been defined as the purposeful application of knowledge and information in the design, production and utilisation of goods and services, and in the organisation of human activities (Das and Van de Ven, 2000). Technology is a key tool which can be used to improve the movement of people and goods in order to meet the evolving needs of modern economy and society. For example, intelligent transport systems (ITS) is a technology toolkit involving a systems approach to transport, which facilitates effective infrastructure management and encompasses road safety (European Transport Safety Council, 1999). The Organisation for Economic Cooperation and Development, OECD (2009) classified industries as high, medium and low technology, based on research intensity and the rate of use of technology. In this classification, the road construction industry falls into a low technology category.

Road infrastructure can be described as a large technical system consisting of physical components such as roads, bridges and traffic monitoring equipment which forms a network (Caerteling et al, 2011). It is a public space, used by all, and often controlled by the use of signs, regulations and dynamic route information which are organised to optimise traffic flow. Road infrastructure appears to be a major sector, a vital component for economic activity, and an important contributor to both Gross Domestic Product and employment (OECD, 2008; European Union Road Federation, 2007). Thus a well-established road transport infrastructure is seen as an important precondition for economic growth (Demurger, 2001).

Roads are often grouped into natural surface roads, concrete roads, hot mix asphalt (HMA) roads and roads surfaced with component pavements. However the bulk of road works concerns concrete and HMA surfaced roads. Concrete and HMA are mixed in regional facilities and transported by trucks to the construction site, where they are laid down and finished to the final product. Roads typically have to be produced at the location of use, hence the road construction industry is widely distributed and fragmented. Modern site equipment is well developed and uses high technology components, however, the operatives and site crew are mainly low educated, and often recruited per job (Caerteling et al, 2011; 2008). The majority of roads are owned by the public sector (federal/national, regional/state and local governments), hence, the entrepreneurial environment of the industry is shaped by the public sector procurement policy and practice (Caerteling et al, 2008).

## Relationships

The issue of the relationship between public and private investment has been a focus of attention in the literature since the early 1980s, and it is still the subject of considerable controversy (Khan and Reinhart, 1990). Thus the interaction between project participants is often a key factor in project management. Interactive processes include planning, communication, monitoring and control, and project organisation in order to facilitate effective coordination throughout the project life. Inter-organisational conflicts in a construction project most often have adverse effect on project performance (Mohsini and Davidson, 1992). Therefore, the government plays pivotal roles and is responsible in the development and management of partnership projects. The incapability of governments to manage partnership projects may lead to project failure (Kwak, 2002). In this regard, many projects are worth mentioning. In a comparative study of three transportation projects delivered through public private partnerships: the Croydon Tram-link in London, UK; the

State Route 91 Express Toll lanes in Orange County CA, United States; and the Cross City Tunnel in Sydney, Australia; Siemiatycki (2010) observed that key planning documents were made secret and confidential, project construction costs escalated, and traffic volume was overestimated in all the three case studies. Consequently, lawsuits ensued as relationships between the parties deteriorated and all the three concessions were ultimately sold under duress. In this respect, Jacobson and Choi (2008) identified open communication and trust, willingness to compromise and collaborate, and respect as important factors for successful delivery of public private partnership projects. This is supported by Innes and Booher (2004) who emphasised the need for building trust between project stakeholders and resolving conflicts before they become intractable.

The Bangkok Elevated Transport System project, Thailand, was a 60km elevated rail system and a road planned to be constructed through the heart of the capital. Hopewell, the concessionaire, was granted the right to develop 900,000m<sup>2</sup> of land along the proposed route in addition to collecting tolls for a concession period of 30years under a BOT arrangement (Kumaraswamy and Zhang, 2001). It was reported that by the end of 1997, only a few piled foundations had been erected, whereas, the first stage of the project ought to have been completed by the end of 1995. This project was ultimately terminated by the Thai Government. The problems leading to the non-realisation of the project include: a sudden request by the government to change from an elevated to an underground scheme following several changes in governments, lack of governmental assistance in resolving the conflicts with a nearby competitive toll-way, and the inability of Thai Government to meet the financial demands of mass transportation (Tam and Leung, 1997). Similarly, the Bangkok Second Expressway System and Bangkok Don Muang Tollway BOT projects in Thailand also failed as a result of immature legal and regulatory system, and the changing foreign investment policy resulting from several changes of government (Tam, 1999).

The World Bank highlights further the reasons why many partnership projects were not delivered. These include: wide gaps between public and private sector expectations, lack of clear government objectives and commitment, complex decision making, poorly defined sector policies, inadequate legal/regulatory frameworks, poor risk management, low credibility of government policies, inadequate domestic capital markets, lack of mechanisms to attract long-term finance from private sources at affordable rates, poor transparency, and lack of competition (Asian Business, 1996). In the failed cases, governments and the end-users/general public (not the private operators) have ultimately shouldered the cost of failure. Project success can be guaranteed if participants work together as a team with predetermined common goals, objectives and defined procedures for collaborative engagement (Larson, 1995). Both the public and private sector partners may need to share a common goal of reducing risk and increasing public procurement certainty, and have the capacity to execute their roles. The roles include the ability to assess costs and needs, the skills to manage and negotiate a public private partnership, and the capacity to monitor and enforce contracts (Zhang, 2005C). Lack of private participants with the capacity to do business also seems to be a significant barrier to the success of public private collaboration (Henderson and McGloin 2004).

## Trust

Trust can be described as a firm belief, confidence and hope in the reliability, truth, ability or strength of someone or something. In other words, it is often a firm reliance on the integrity or

character of a person or thing (Bies et al, 1995). Rousseau et al, (1998) defined trust as a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behaviour of another. In practice, trust could be both an emotional and logical act. Trust could be emotional where an individual exposes his/her vulnerabilities to other people, but believing that such people would not take advantage of his/her openness. It could be logical in a situation where an individual assesses the probabilities of gain and loss, calculates expected utility based on hard performance data, and concludes that the other person would behave in a predictable manner. Trust can be felt hence its associated emotional feelings often include companionship, friendship, love, agreement, relaxation, and comfort (Hosmer, 1995). The predictability of trust allows one to spot and prepare for threats and also make plans to achieve long-term goals. Trust may have to do with being able to predict what other people will do, and what situations will occur. Therefore, relationships and business transactions in most cases revolve around trust in value-exchange, hence, the principle of reciprocity often binds societies together (Kramer and Tyler, 1996).

It has been widely acknowledged that trust is an important hall-mark of effective organisations, and has a number of important benefits for organisations and their members (Bies et al, 1995; Hosmer, 1995; Kramer and Tyler, 1996; Rousseau et al, 1998). Trust often results in more positive attitudes, higher levels of cooperation (and other forms of workplace behaviour), and superior levels of performance (Mayer et al, 1995; Jones and George, 1998). Mayer et al (1995) claimed that individuals' beliefs about another's ability, benevolence and integrity often lead to a willingness to take risk in a relationship. In other words, a higher level of trust in a work partner increases the likelihood that one will take a risk with that partner, and/or increase the amount of risk that is assumed. Therefore, risk-taking behaviour is often expected to lead to enhanced outcomes and higher unit performance in social units such as work groups, collaboration, negotiation, communication and information sharing (Dirks and Ferrin, 2001). Individuals tend to transmit more information with higher fidelity, to a trusted superior or work partner, hence, trust is often a necessary condition for cooperation (Hwang and Burgers, 1997). In this respect, an individual who considers another to be dependable will find it relatively easy to collaborate with that partner, and directs resources towards the group goal without being anxious about the partner's potential behaviour (Dirks and Ferrin, 2001).

Trust theory emphasises three important antecedents of interpersonal trust, these include ability, benevolence and integrity (Mayer et al, 1995). Ability refers to skills, competencies and characteristics relevant to a specific situation, while benevolence encompasses loyalty, receptivity and care. Integrity involves adherence to acceptable set of principles such as consistency, fairness, reliability, openness and general value congruence. There is a real issue to avoid the 'blame culture' (Khalfan et al, 2007) as the impact of trust can have a positive impact on project outcomes (Laan et al, 2011).

## Market Maturity

Since year 1992 to date, it appears there has been an increased and significant use of public-private collaboration to procure infrastructure services in both developed and developing countries. The maturity and sophistication within international markets also seem to be at different stages of development. Today, the UK has been recognised as the most active market in the world for public-private collaboration with well developed institutional, legal, regulatory and business structure to support the expansion of this strategy (Deloitte, 2006).



Additionally, the UK is considered to have the most expansive project portfolio in terms of both the diversity of infrastructural provision as well as innovative application of the collaborative model. This is closely followed by Australia with vast experience, substantial institutions and record of numerous road transport infrastructure projects being delivered in the New South Wales through the design-build-finance-operate (DBFO) collaborative approach (Siemiatycki, 2010). Partnerships UK (2007) claimed that the diversity of PFI/PPP application across government departments has created an intellectual family within the UK in respect of partnership based procurement, encompassing a market of experienced suppliers and advisors as well as a robust contractual framework. The range of contractors and service providers appear diverse and includes construction contractors, hard facility management (FM) contractors and soft FM contractors. Hard FM contractors typically provide utilities management and asset maintenance, while soft FM contractors deliver services such as security, cleaning, catering and help desk operations (Royal Institute of Chartered Surveyors, RICS, 2011).

Similarly, other countries such as Ireland, Spain, Canada, France, USA and China seem to be well placed, on what Deloitte (2009) referred to as the 'market development curve' for transportation sector. The UK, Australia and Canada are often considered amongst the most mature and transparent collaborative global markets, even though they differ considerably in terms of regulatory frameworks, scope and volume of collaborative projects, infrastructural-target and duration of the tender process. India and the USA seem to have witnessed substantive growth in the application of PPPs as a method of infrastructure procurement over the last five years (2006-2010). Both countries are rated as 'emerging' markets in the context of collaboration. The partnership markets in the USA and India seem to represent a wholesome learning environment in terms of the challenges that must be overcome in order to facilitate continued growth as well as enhancing market maturity and sophistication. The markets in both India and the USA appear to offer the opportunity to transfer knowledge in terms of innovative application and risk-shift mechanisms (RICS, 2011).

For a country to move up the market maturity curve, it may be required that she expands and develops her market capacity, involving the execution and management of innovative partnership models and financial structures. However, public sector institutions in developing countries have been reported to be weak, have poor economic resource base, and inadequate regulatory framework. In similar vein, the private sector has been described as young, inexperienced and probably lacks the resources (financial, technical, managerial capabilities and innovative competencies) to effectively collaborate (Charles, 2006). The inability of the private sector to secure fund to finance essential infrastructural provision due to current global financial crisis attracted national government interventions. For example, Canada created the Canada Fund, the UK government established the Infrastructure Finance Unit (IFU) while the French and Australian governments launched federal guarantees on partnership projects. These interventions are expected to stimulate the partnership market, generate construction sector employment, contribute to wider economic growth and instil greater confidence in collaborative model, most especially within the banking sector (RICS, 2011).

### Skills/Competence

Projects are often managed by people who probably have to make decisions and enforce procedures that might affect other people. Managing even a small project may require careful attention to details and the ability to anticipate possible problems. Therefore, management

skills, principles and competencies may be necessary in order to keep track of all the activities and issues associated with infrastructure project implementation and execution. These skills and principles may include planning, organising, controlling, coordinating, motivating, communicating, procuring, leading, delegating and negotiating (Fayol, 1949). Project management tends to apply these skills and techniques to the organisation and control of all aspects of every project in order to optimise the use of resources to produce a well designed, soundly constructed, functional and financially viable facility that will satisfy the clients' requirements of quality, purpose, safety, cost and time budget, and future maintenance (Chartered Institute of Building, 2010).

## Communication

Project communication management has been described as the knowledge area that employs the process required to ensure timely and appropriate generation, collection, distribution, storage, retrieval and ultimate disposition of project information (Project Management Institute, 2002). Management often relies on clear communications, and the ability to pass thoughts, ideas, information and instructions quickly and effectively between people with different technical skills and interest. Effective communications may occur in two ways, informal and formal. Informal telephone conversations, oral or face to face communications may be necessary for establishing personal relationships, for the speedy and effective resolution of problems, and for deciding upon courses of action. Yet, formal communications might be required to ratify the decisions made informally, to record the main reasons for a decision, and to communicate relevant information to people who probably were not involved in decision-making (Cleland and Gareis, 2006). In this respect, many of the reports and procedures such as application for funds, certification and payments, periodic reports and financial accounts of a project are prepared in a well-established standard way in order to avoid ambiguity and reduce the risk of dishonest manipulations. Project drawings, specifications, bill of quantities, schedules, articles of agreement and other contract documents may be regarded as forms of formal communications (Project Management Institute, 2010).

## STRATEGIES FOR DELIVERING SUSTAINABLE INFRASTRUCTURE PROJECTS

The World Commission on Environment and Development (1987) defined sustainable development as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The complex and evolving nature of risks involved in partnerships and the large numbers of project stakeholders make it both necessary and expedient to adopt relational contract approaches in order to secure a sustainable product and service (Kumaraswamy and Zhang, 2003). Thompson and Sanders (1998) observed that the benefits of relational approaches increase with a progression of teamwork attitudes from competition, through cooperation to collaboration and finally coalescence. Under coalescence, the project team members work as a virtually seamless team. In effect, value for money is often realised because costs are shared, economies of scale and synergies are achieved while decision making is shortened due to cooperation between partners (Klijn and Teisman, 2000; Ke et al, 2009). In this respect, MacNeil (1974) traced the development of contracts from traditional 'classical' through 'neoclassical' to 'relational'. Classical contracting approaches are often characterised by segregated teams, adversarial contracts, a blame culture and short-term focus; while relational contracting approaches on the

other hand, are characterised by integrated teams, joint risk management, sustainable relationships and a longer-term focus.

Furthermore, relational contract principles seem to provide a sound basis for harmonising relationships between the contracting parties, thereby reducing areas of disagreements and lubricating transactional frictions. This is made possible by focussing on common objectives, adopting cooperative and collaborative approaches, and introducing compatible and useful processes over and above classical contracting practices and principles (MacNeil, 1978). Relational contract approaches often engender proactive project delivery modalities by fostering cooperation between project team members with a longer-term mind-set, and focussing team efforts on whole-lifecycle performance and sustainable infrastructure. Thus, 'tension' is reduced between the public and private sector participants, thereby facilitating integrated team-work with a long time horizon (Rahman and Kumaraswamy, 2002).

## DISCUSSION

The long-term nature of public private collaboration might allow trust to grow and consolidate among project team members, just as an effective partnership seems to be a way of integrating the public and private sectors which often bring the benefit of private sector expertise and experience to bear on public sector management. A good interaction between project participants might be paramount in project management. In this regard, Kumaraswamy and Zhang (2003) suggested the need to identify the degree of trust and mutual credibility of the parties in relationships. Moreover, high levels of trust often enable relationships to be built up faster and better, while the tendencies of one party to default on agreements, exploit loopholes or let down another party would be minimal. For example, performance specifications which clearly state the desired end results of projects are increasingly used in all infrastructure construction works. However, since the specifications are always silent on construction methods, disputes could arise as a result of different interpretations of end results which would require sound and a long-term 'relational understanding' solution.

Furthermore, relational approaches appear to be useful in pooling the resources of project stakeholders towards win-win scenarios, that can extend beyond a single project (e.g. in framework agreements and term contracts), and also benefit from a longer-term view (e.g. by focussing on sustainable infrastructure). While contractual arrangements attempt to cover all foreseeable eventualities, relational approaches are also crucial for developing relationally integrated teams that can respond rapidly and efficiently to unforeseen risks as well as technological and socio-economic developments during the life span of the infrastructure.

The need for appropriate identification, classification and allocation of risk is also espoused in the extant literature. Joint risk management, according to Rahman and Kumaraswamy (2002) often ensures clear and equitable allocation of all foreseeable risks, along with relational contract based adjustment mechanisms for addressing any unforeseen events and changes during contract execution. Furthermore, the seminal literature also emphasised the role and importance of having an equitable legal and regulatory framework. This framework should explain the changed roles (or redefined roles) of government, from providing and delivering services directly, to facilitating and regulating private sector service provision. The framework is necessary to protect public interest, check abuses, enhance capacity and promote public private collaboration. The private sector will only invest in a project where

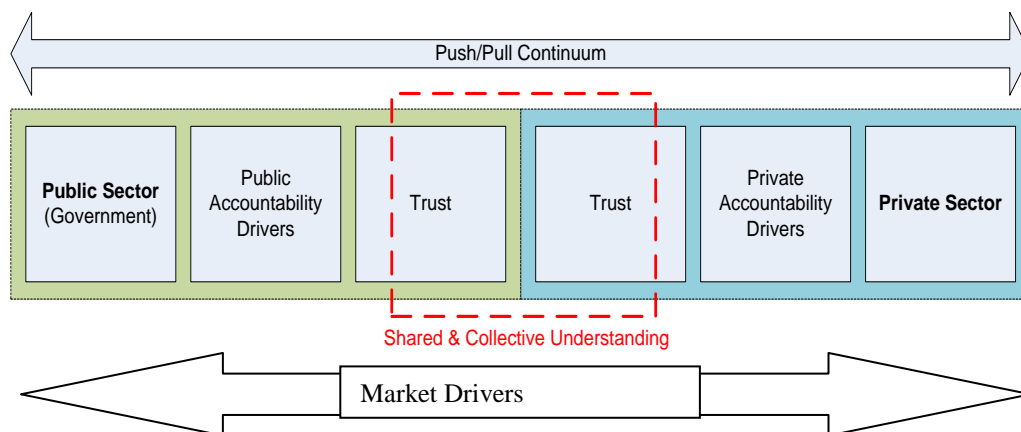
there is an assurance that it would certainly make an adequate profit. It was a consensus of opinion by all scholars that the private sector has the technical, financial, managerial and entrepreneurial capacity to invest in, and turn-around public infrastructure projects. For simplicity, 10 core themes have been identified; these being the most commonly cited issues in this subject area. An outline of seminal literature on these core themes is given in Table 1.

**Table 1: Seminal Literature on Public-Private Sector Collaboration**

Core drivers	Authors
<b>Relationships</b>	Khan and Reinhart 1990; Mohsini and Davidson 1992; Kwak 2002; Siemiatycki 2010; Jacobson and Choi 2008; Innes and Booher 2004; Tam and Leung 1997; Larson 1995; Ke et al 2009; Klijn 2000; Erridge & Greer 2002; Ysa 2007; Zhang and Kumaraswamy 2001; Zhang et al 2002, 1998; Zhang 2004, 2005C; Henderson and McGloin 2004; Abdul-Aziz 2001; Chan et al 2003; Wang et al 1998, 1999, 2000; Wang and Tiong 1999,2000; Ling 2004; Khan and Reinhart 1990; Asian Business 1996
<b>Trust</b>	Bies et al 1995; Rousseau et al 1998; Hosmer 1995; Kramer and Tyler 1996; Mayer et al 1995;Khalfan et al 2007; Laan et al 2011; Jones and George 1998; Dirks and Ferrin 2001; Hwang and Burgers 1997; Banks 2005; Rhaman and Kumaraswamy 2002; Kumaraswamy and Zhang 2003; MacNeil 1974; 1978; Thompson and Sandars 1998; World Commission on Environment and Development 1987; Spackman 2002; World Bank 2008; Mohsini and Davidson 1992; Siemiatycki 2009; Larson 1995; Tang et al 2010
<b>Risk Allocation</b>	Ward and Chapman 1991; Edwards 1995; Flanagan and Norman 1993; Woodward 1997; Charoenpornpattana and Minato 1997; Merna and Smith 1996; Li et al 2005; Abednego and Ogunlana 2006; Li et al 2005,1999; Shen et al 2006; Akintoye et al 2000, 1998; Sheu and Akintoye 2010, 2009; Li and Tong 1999; Schaufelberger and Wipadapisut 2003; Mustafa 1999; Zayed and Chang 2002; Lam and Chow 1999; Bing 2005; Dixon 2005; Regan 2005; Canakci 2006; Asian Business 1996; Tam 1999; Macdonald 2000; Grimsey 2002; Henderson 2004; Tang et al 2010; Rahman and Kumaraswamy 2002; Zhang 2005A
<b>Legal and Regulatory Framework</b>	Asian Development Bank 1996; 1997; Harris 2003; Birgonul and Ozdogan 1998; Canakci 2006; Asian Business 1996; Tam and Leung 1997; Larson 1995; Kumaraswamy and Zhang 2001; Zhang 2005B ; Bing et al 2005; Institute of Public Private Partnership 2000; Kuttner 1997; Pongsiri 2002; Tam 1999; Kanter 1994; Shalakany 1996; Tang et al 2010; Pahlma 1996
<b>Communication</b>	Project Management Institute 2002, 2010; Cleland and Gareis 2006; Jacobson and Choi 2008; Innes and Booher 2004; Siemiatycki 2009; Tam and Leung 1997; Asian Business 1996; Tam 1999; Kumaraswamy and Zhang 2003; Samii et al 2002; Regan 2005; Tang et al 2010; Asian Business 1996; Jamali 2004
<b>Technology</b>	Das and Van de Ven 2000; European Transport Safety Council 1999; Organisation for Economic Cooperation and Development 2008, 2009; Caerteling et al 2008, 2011; European Union Road Federation 2007; Demurger 2001; Freeman 2007; Estache et al 2005; Kumaraswamy 1998; Chen 2002; Li 1998; Tang et al 2010; Akintoye et al 2001
<b>Skills/Competence</b>	Chartered Institute of Building 2010; Fayol 1949; Kumaraswamy 1998; Birgonul and Ozdogan 1998; Tam 1999; Tang et al 2010; World Bank 2008
<b>Finance</b>	Merna and Dubey 1998; Zhang and Kumaraswamy 2001; Zhang 2005B; Zhang 2005C; Levy 1996; Akintoye et al 2003; Norwood and Mansfield 1999; Huang and Chou 2006; Saunders 1998; Kumaraswamy 1998; Tam and Leung 1997; Asian Business 1996; Rondeinelli 2004; Asian Development Bank Report 1996; Tang et al 2010; Liddle 1997; Pongsiri 2002; Pahlma 1996
<b>Globalisation/Collaboration</b>	McGrew 1992; European Commission's Directorate-General for Energy and Transportation 2006; Collin 1998; Grant 1996; Yakowenko 2004; National Economic Development Office 1986; Gomez-Ibanez 1996; Sclar 2001; Grimsey and Lewis 2005; Liu and Cheah 2009; Tam 1999; Kumaraswamy 1998; Kumaraswamy and Morris 2002; Akintoye and Beck 2009; Mytelka 2000
<b>Market Maturity</b>	Deloitte 2006, 2009; Siemiatycki 2010; Partnerships UK 2007; Royal Institute of Chartered Surveyors 2011; Charles 2006; Asian Business 1996; Henderson and McGloin 2004; Rondeinelli 2004; Woodward 1997; Charoenpornpattana and Minato 1997

The severity of the current global financial crisis is underscored by the collapse of large financial institutions which constitute the pillars of the global economy. Other consequences

of the global economic meltdown are negative economic growth, growing unemployment, rising inflation and crashing stock markets. Collaborative engagement approaches for delivering sustainable infrastructure might be alternative strategies for cushioning the effects of the global recession. This approach may re-define the role of government in infrastructure provisioning, transforming its status from a provider to that of an enabler and regulator. This shift in the method of infrastructure delivery underscores the realisation that the traditional approach probably is no longer sustainable in the face of the dwindling resources of the state and inefficiency in the public sector. A new and increasingly popular strategy of social service delivery with global endorsement, brings to the fore the need for private sector participation in the management of infrastructure both in terms of providing the needed huge capital, and injecting greater efficiency into the operation of public utilities. The attributes, motive, interest and operational strategies of the private sector often differ from that of the public sector. For example, the goal of the public sector is to provide equal social welfare services to the citizens, while the private sector on the other hand aims at maximising profit on investment. These conflicting objectives often create push-pull forces between the two sectors as shown in Figure 1.



**Figure 1: Equilibrium of Push-Pull forces between public and private Sectors**

This framework would allow stakeholders (Public and Private sectors) to partner/work together and share risks, responsibilities, resources, rewards, skills and assets in order to deliver sustainable infrastructure for the general public. The framework is a mechanism that would lower divergences in interests and foster cooperation.

## CONCLUSION

The provision of infrastructure services is a critical factor for economic growth and contribution to GDP. For example infrastructure, is the capital stock that provides public goods and services, the provision of which acts as a formal conduit for leveraging economic and market drivers. Through traditional procurement systems, the government/public sector builds or purchases a physical asset, retains ownership, and operationalises these (along with the associated risks) to deliver the required service. In this respect, extant literature is now highlighting the importance of embracing new collaborative engagement approaches to effectively share and manage risks and rewards.

Given these developments, private investment through an array of models is increasingly playing an important role in public infrastructure services development in particular.



Moreover, private sector on the other hand seems to be well placed in providing bespoke skills and services to deliver infrastructure needs. Notwithstanding this, it is advocated that an important ‘ingredient’ in collaborative arrangements is that of trust. Building and developing trust through effective communication between project participants is often cited as being crucial to project success. Given this, Public-Private sector collaboration can be used to leverage a unique ‘esprit de corps’ to deliver customer satisfaction, ‘value for money’ and win-win positions.

This paper identified relationships, trust, risk allocation, legal and regulatory framework, communication, technology, finance, skills/competence, globalisation/collaboration and market maturity as the 10 vital areas that impinge upon collaborative arrangements. These areas need to be appropriately captured, managed and aligned to existing business models to successfully deliver sustainable infrastructure projects. Research findings underpin the need to support these 10 core drivers through some formal model/framework. Thus the implications from this research advocate the need to capture and prioritise both cognate and non-cognate drivers in order to assess the magnitude of the ‘push-pull’ continuum identified in Figure 1.

Whilst from an epistemological perspective it is acknowledged that contextual positioning and regional (country-specific) conditions/constraints may influence and govern the operationalisation of this model/framework. These 10 factors can be considered as bounded variables which impact upon generalisability and repeatability.

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